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CITRUS JUICE PRODUCT

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The invention relates to the manufacture of extended citrus juices such as orange juice and intermediate products having enhanced commercial values. The invention will be described primarily in connection with orange juice, it being understood that it may be applied to other citrus juices.

It is known to make orange-flavored beverages through the use of flavoring materials such as the oil recovered from the skins of oranges, sugars, citric acid and similar ingredients. While beverages sufficiently palatable to attain commercial success can be made in this way, the beverages themselves have a highly artificial flavor and are not comparable to natural orange juice.

Natural orange juice, however, is relatively expensive as a beverage. If consumed in areas where oranges are not grown, the product must be shipped either in the form of whole oranges or in the form of juices. Obviously this entails considerable expense. While it is somewhat less expensive to ship bulk juice than whole oranges, the juice itself has a relatively short life and must be maintained under conditions of refrigeration. Considerable development work has been done in the field of producing orange juice concentrates designed to be diluted with water to the consistency of natural orange juice at the point of use. Serious problems are involved, inasmuch as many methods of forming concentrates involve significant degradation of flavor. Certain methods and apparatus have been developed for the production of full-flavored concentrates, as hereinafter set forth; but if the concentrates are to have any substantial life they must be maintained under refrigeration to avoid deterioration. Many orange juice concentrates are in fact sold and shipped in frozen condition.

Thus, although there is evidence of a strong preference on the part of the buying public for orange juice over other beverages which are normally consumed in a chilled condition, the factors noted above have made it generally impossible for the public to secure natural orange juice, or a beverage having the same taste characteristics, at a price comparable to the price of other chilled beverages.

Hitherto there has been no way in which natural orange juice could be extended by dilution with retention of full and natural flavor characteristics. If natural orange juice is merely diluted with water it becomes, as might be expected, thin, relatively pale, and relatively insipid in flavor. It is possible to dilute an orange juice with water and then build back its sugar-acid ratio to the equivalent of whole juice, as by the addition of citric acid and sugar; but a beverage produced in this fashion suffers from the fact that its flavor is still either insipid or artificial or both. Nor are attempts effective to build back the flavor with natural or synthetic flavoring materials, since the net result is an increasingly artificial taste.

One of the objects of this invention is the provision of an extended juice which is similar in all respects, including flavor, to natural, whole juice.

Another object of the invention is the provision of products which are capable of great extension by dilution, but at the same time avoid the difficulties outlined above.

Yet another object of the invention is the provision of concentrates involving the ingredients of natural juice and capable of the aforesaid great extension, which products have a long life and excellent keeping qualities, and in particular do not require refrigeration.

Other objects of the invention have to do with methods for obtaining the products and results outlined above.

These and other objects of the invention which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications, are accomplished in those products and by those procedures of which certain exemplary embodiments will later be described.

The present invention is based upon the discovery (*a*) that while the quantity of flavor-imparting materials (esters, or essential oils) in natural orange juice is far above the level which can be appreciated by the taste buds or sensory system of a human being, so that dilution becomes possible, (*b*) the actual effect of the flavoring materials is dependent upon various factors not in themselves bound up with the essential oils or esters. Essential ones of these factors are salts, without which the esters in a diluted juice cannot produce a natural effect.

As a preliminary consideration, in a diluted product, the sugar-acid ratio and Brix value should be maintained, which can be done by appropriate additions of citric acid and sugar; but as set forth above this will not restore the flavor. The sugar-acid ratio in orange juice is generally between 11:1 and 17:1, while in grapefruit juice it is generally between 7:1 and 11:1. The maintenance of the sugar-acid ratio by appropriate additions of citric acid and sugar has been found to disturb the pH. This must be restored to an acceptable range, broadly 2.8 to 3.8. The pH of natural sweet orange juice, while variable, will usually be about 3.4 to 3.6, and this is a preferred range for the present invention.

The control of the pH is preferably accomplished by the use of relatively small quantities of organic or inorganic buffers. By way of example a relatively very small quantity of sodium citrate, in the presence of citric acid, will serve to raise the pH of a diluted product having a correct sugar-acid ratio, from an unduly low value say 2.5 to the entirely acceptable value of 3.5 and to maintain it there throughout the life of the product. Sodium succinate is an organic buffering agent having a similar effect. Sodium phosphate and potassium dihydrogen phosphate are other non-limiting examples of buffering agents.

But the flavor of the diluted orange juices has been found to depend on other materials. These, for the most part are salts, inclusive of such materials as calcium chloride, magnesium chloride, sodium or potassium citrates, tartaric and malic acids and their salts. These also are used in very small amounts. It will be noted from the inclusion of sodium and potassium citrates in the above examples that these salts are capable not only of acting in the presence of citric acids as buffering agents, but also are capable of acting as flavor-enhancing materials. The importance of these various additives is that in various combinations they affect the flavor of diluted orange juice in such a way as to avoid entirely the insipidizing effect of dilution per se, without in any way contributing foreign or artificial tastes and odors. They make it possible to extend whole orange or grapefruit juices very greatly while relying on their natural contents of characteristic essential oils which, as explained above, have been discovered to be far in excess in the natural product of the quantities required for full flavor. The dilutions contemplated may extend from 1:1 to as much as 1:4 with the production of products of completely natural taste and full flavor. Indeed, repeated tests with panels of blindfolded persons have demonstrated that it is not possible to distinguish the diluted products of this invention from undiluted natural fresh orange juices. Where the word "taste" is used herein the effect